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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/710,409	07/08/2004	Kangguo Cheng	FIS920030399US1	4408

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EXAMINER	
SARKAR, ASOK K	

ART UNIT	PAPER NUMBER
2891	

DATE MAILED: 10/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/710,409	CHENG ET AL.	
	Examiner	Art Unit	
	Asok K. Sarkar	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 July 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *20* is/are allowed.

6)☒ Claim(s) *1,2 and 4-19* is/are rejected.

7)☒ Claim(s) *3* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 July 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/8/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1, 2, 4, 6 – 12, 15 and 16 are rejected under 35 U.S.C. 102(b) as being anticipated by Gaillard, US 6,531,398.

Regarding claim 1, Gaillard teaches a method comprising:

- depositing on a surface of a substrate a layer formed of a material comprising carbon, hydrogen and at least one element selected from the group consisting of Si, Ge, B, Sn, Fe and Ti, especially silicon in column 4, lines 23 – 38; and
- annealing said layer in an environment comprising hydrogen thereby forming an annealed layer in between column 4, lines 66 and column 5, line 2.

Regarding claim 2, Gaillard teaches the material further comprises oxygen in column 4, lines 30 – 37.

Regarding claim 2, Gaillard teaches deposition by PECVD in column 3, line 47.

Regarding claims 6 – 8, Gaillard teaches the material comprises carbon in an amount of about 0.5 to 95 atomic %, hydrogen in an amount of about 0.5 to 50 atomic

%, Si in an amount of about 0.5 to 95 atomic %, and O in an amount of about 0.5 to 70 atomic % since the material deposited from the organosiloxanes and annealed in hydrogen will inherently have compositions of C, H, Si and O within these ranges.

Regarding claim 9, Gaillard teaches annealing environment contains hydrogen in an amount of about 0.1 to 100 % in between column 4, lines 66 and column 5, line 2.

Regarding claims 10 – 12, Gaillard teaches annealing is performed at a temperature of about 350^{O}C to 500^{O}C and for a duration of about 1 min to 100 min in column 5, lines 6 – 12.

3. Claims 21 – 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Li, 6,579,630.

Regarding these claims, Li teaches a structure comprising plurality of layers, at least one layer being formed of a material comprising carbon, deuterium, Si, O and hydrogen with reference to Fig. 2 in column 4, lines 54 – 63, column 8, lines 23 – 30 and in column 10, lines 45 – 56.

4. Claims 21 – 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Khanarian, US 2003/0008244.

Regarding these claims, Khanarian teaches a structure comprising plurality of layers, at least one layer being formed of a material comprising carbon, deuterium, Si, O and hydrogen in paragraphs 27 and 77.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gaillard, US 6,531,398 in view of Angelopoulos, US 6,514,667.

Gaillard teaches a PECVD process but fails to teach performing the process in a parallel plate reactor with substrate sitting on an electrode.

Angelopoulos teaches a PECVD process for forming a Si:C:H:O material layer wherein the PECVD process is performed in a parallel plate reactor wherein the substrate is placed on an electrode in column 8, lines 50 – 55 for the benefit of tuning the properties of the film by the deposition process in column 5, lines 50 – 55.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Gaillard and perform the PECVD process in a parallel plate reactor wherein the substrate is placed on an electrode for the benefit of tuning the properties of the film by the deposition process as taught by Angelopoulos in column 5, lines 50 – 55.

9. Claims 13 – 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gaillard, US 6,531,398 in view of Angelopoulos, US 6,514,667.

Regarding claims 13 and 14, Gaillard teaches a load wafer processing system with reference to Fig. 1 wherein he teaches that various processes can be performed in either one chamber or can be performed in separate chambers. He, however, fails to teach deposition and annealing performed in the same chamber or in two different chambers.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Gaillard and perform deposition and annealing either in the same chamber or in two different chambers depending on the set up of the wafer processing system since all four chambers are available for the wafer processing in a single system.

Regarding claims 15 and 16, Gaillard teaches annealing in hydrogen, but fails to teach the hydrogen content of the annealed layer between 10 to 50 atomic %.

However, it would have been obvious to one with ordinary skill in the art at the time of the invention to optimize the annealing conditions and adjust the hydrogen concentration within 10 to 50 atomic % so that the dielectric constant of the material is suitably adjusted.

10. Claim 19 ise rejected under 35 U.S.C. 103(a) as being unpatentable over Gaillard, US 6,531,398 in view of Ramkumar, US 6,436,799.

Gaillard teaches hydrogen annealing, but fails to teach annealing in deuterium so that the annealed layer comprises at least one of hydrogen or deuterium in a concentration which is greater at an interface with said substrate than at other portions of the layer.

Ramkumar teaches that hydrogen annealing is used to passivate the dangling bonds that are present in the silicon/silicon oxide interface in column 1, lines 8 – 15 and annealing in deuterium is even better due to the formation of stronger deuterium – silicon bonds at the interface compared to that of the hdrogen – silicon bonds in column 1, lines 32 – 35.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Gaillard and anneal the layer in deuterium for the benefit of forming stronger deuterium – silicon bonds and as taught by Ramkumar when the layer is formed on a substrate it will passivate the dangling bonds at the interface compared to that of the hdrogen – silicon bonds and therefore the concentration of the

hydrogen and/or deuterium will be greater at the interface as taught by Ramkumar in column 1, lines 32 – 35.

Allowable Subject Matter

11. Claim 20 is allowed.

12. Claim 3 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter: Claims 3 and 20 recite, inter alia, a method comprising depositing on a surface of a substrate a layer formed of a material comprising carbon, deuterium and at least one element selected from the group consisting of Si, Ge, B, Sn, Fe and Ti; and annealing said layer in an environment comprising at least one of hydrogen and deuterium, thereby forming an annealed layer. The art of record does not disclose or anticipate the above limitation of forming the material layer containing deuterium and then annealing in combination with other claim elements nor would it be obvious to modify the art of record so as to form a device including the above limitation.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

15. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Asok Kumar Sarkar

Asok K. Sarkar
October 5, 2005

Primary Examiner